UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/188,190	11/10/1998	KATSUNORI KANEKO	1472-177P	4015

2292 7590 03/08/2005

BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747

EXAMINER	
NGUYEN, TU MINH	
ART UNIT	PAPER NUMBER
3748	

DATE MAILED: 03/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/188,190	KANEKO ET AL.	
	Examiner	Art Unit	
	Tu M. Nguyen	3748	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 February 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *3,4,6-21,23 and 24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *3,4,6-21,23 and 24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02 October 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. An Applicant's Request for Continued Examination (RCE) filed on February 16, 2005 has been entered. Per instruction from the RCE, an Applicant's Amendment filed on December 16, 2004 has been entered. Claim 5 has been canceled; and claims 6, 18, 23, and 24 have been amended. Overall, claims 3, 4, 6-21, 23, and 24 are pending in this application.

Drawings

2. The formal drawing of Figure 5 filed on October 2, 2002 has been approved for entry.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 8-21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. (U.S. Patent 5,746,989) in view of Hepburn et al. (U.S. Patent 5,974,788) (Hepburn'788).

Re claim 18 and 23, as shown in Figure 1, Murachi et al. disclose an exhaust gas purifying apparatus of an internal combustion engine, comprising:

- a light-off catalyst (5) provided in an exhaust passage and having an O_2 storage capability such that the light-off catalyst passes, there through, at least CO in an exhaust gas to a downstream side of the light-off catalyst when the internal combustion engine is operating under a condition where the oxygen concentration of the exhaust gas is reduced (see line 66 of column 3 to line 8 of column 4) (light-off catalyst (5) has limited oxygen storage capability because when the engine air-fuel ratio is switched to fuel rich, much of HC and CO in the exhaust gas pass through the light-off catalyst (5) unoxidized (lines 29-38 of column 6));

- exhaust gas purifying means (9) provided in the exhaust passage at a downstream position of and in series with the light-off catalyst, the exhaust gas purifying means having a NO_x catalyst (alkaline earth metals such as barium) for adsorbing NO_x in the exhaust gas when an air-fuel ratio of the exhaust gas is lean and releasing the adsorbed NO_x when the oxygen concentration of the exhaust gas is reduced, the exhaust gas purifying means further having a three-way catalyst (platinum) that reacts with the released NO_x (line 50 of column 4 to line 36 of column 5); and

- NOx regeneration means (20, 4) for repeatedly releasing NO_x adsorbed by the NO_x catalyst every first interval (2 minutes) outside the temperature range where SO_x is releasable (releasable temperature for NO_x is lower than that for SO_x (lines 43-49 of column 8)), and SO_x regeneration means (20, 4) for repeatedly releasing SO_x adsorbed by the NO_x catalyst every second interval (60 minutes) independent from and longer than the first interval (see Figure 5 and lines 43-64 of column 8).

Murachi et al., however, fail to disclose that the three-way catalyst of the exhaust gas purifying means (9) has an oxygen storage value greater than an oxygen storage value of the light-off catalyst (5); and that the oxygen storage values are per one liter of catalyst.

As shown in Figure 1, Hepburn'788 teaches an exhaust gas purification apparatus comprising a light-off catalyst (26) and a NO_x trap (32) with both having an oxygen storage capability. They also teach that it is conventional in the art to minimize the oxygen storage capability of the light-off catalyst so that most of the exotherm needed to desulfurize the NO_x trap occurs in the trap rather than in the light-off catalyst (lines 44-52 of column 4). This is also consistent with Murachi et al. who also want to have more unburned fuel to pass through the light-off catalyst (5) unoxidized (lines 29-38 of column 6). It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the light-off catalyst with reduced oxygen storage value in the apparatus of Murachi et al., since the use thereof would have been routinely utilized by those with ordinary skill in the art.

It is well known to those with ordinary skill in the art that when constructing a catalyst with an oxygen storage material, an amount of the oxygen storage material is typically specified in the units of mass per one liter of the catalyst. Therefore, such disclosure by Murachi et al. is notoriously well known in the art so as to be proper for official notice.

Re claim 8, the apparatus of Murachi et al. discloses the invention as cited above, however, fails to disclose that the engine is a spark ignition type four-cycle engine that operates on the four-stroke cycle consisting of a suction stroke, compression stroke, combustion/expansion stroke, and exhaust stroke.

Murachi et al. disclose the claimed invention except for applying the invention to a spark ignition type four-cycle engine. It would have been obvious to one having ordinary skill in the art at the time the invention was made to apply the invention of Murachi et al. to a spark ignition type engine, since the recitation of such amounts to an intended use statement. Note that both "spark-ignition engine" and "diesel engine" generate exhaust gases containing harmful emissions of HC, NO_x, soot, CO, etc, that require purification before the gases can be released to the atmosphere; and the mere selection of the purification system of Murachi et al. for use in a spark ignition engine would be well within the level of ordinary skill in the art.

Re claim 9, in the apparatus of Murachi et al., the internal combustion engine is an in-cylinder injection type engine in which fuel is directly injected into a combustion chamber.

Re claims 10 and 11, the single catalyst of the exhaust gas purifying means (9) in the apparatus of Murachi et al. includes a function of the three-way catalyst.

Re claim 12, the light-off catalyst (5) in the apparatus of Murachi et al. includes a single catalyst that functions as the three-way catalyst (line 66 of column 3 to line 16 of column 4).

Re claim 13, the exhaust gas purifying means (9) in the apparatus of Murachi et al. further functions also as the NO_x catalyst.

Re claim 14, the light-off catalyst (5) in the apparatus of Murachi et al. also functions as a SO_x catalyst to oxidize and convert SO_2 in the exhaust gas to a sulfate which can be absorbed by the exhaust gas purifying means (lines 22-26 of column 8).

Re claim 15, in the apparatus of Murachi et al., the condition where the oxygen concentration of the exhaust gas is reduced includes a fuel rich operating condition (lines 29-45 of column 6).

Re claim 16, in the apparatus of Murachi et al., the light-off catalyst (5) mainly purifies HC in an exhaust gas emitted from the engine in a cold state (since the light-off catalyst (5) in Murachi et al. has a low oxygen storage capability as compared with that of the exhaust gas purifying means (9) and is located closer to an outlet of the engine where the exhaust gas temperature is still relatively high, the light-off catalyst reaches an activation temperature at an earlier time in order to purify HC emitting from the engine in a cold state).

Re claim 17, in the apparatus of Murachi et al., the light-off catalyst (5) is provided in the exhaust passage immediately downstream of the internal combustion engine.

Re claims 19 and 20, in the apparatus of Murachi et al., the light-off catalyst (5) includes a three-way catalyst having a function of an oxidizing catalyst (line 66 of column 3 to line 16 of column 4).

Re claim 21, in the apparatus of Murachi et al., the control means sets the air-fuel ratio leaner as compared to an air-fuel ratio required to release the adsorbed NO_x from the NO_x catalyst is used in conjunction with a three-way catalyst in which the oxygen storage capability is not reduced (the exhaust gas purifying means (9) also includes platinum (line 54 of column 4) as a three-way catalyst which has a non-reduced oxygen storage capacity).

5. Claims 3-4 and 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of Hepburn'788 as applied to claim 23 above, and further in view of design choice.

Re claims 3-4, the apparatus of Murachi et al. discloses the invention as cited above, however, fails to disclose that an amount of oxygen absorbed on the light-off catalyst is not greater than about 150 cc per one-liter volume of the catalyst when measured by an oxygen pulse method and that an oxygen component stored in the light-off catalyst is not greater than about 25 gr per one-liter volume of the catalyst.

One having ordinary skill in the art of exhaust emission control would have recognized that the specification of the maximum volumetric or weighted amount of oxygen absorbed in a light-off catalyst would be a function of many variables such as the size of the light-off catalyst, engine size, engine operating conditions (load, speed, etc), air and fuel properties, capacity and size of a main catalyst, etc. Moreover, there is nothing in the record which establishes that the claimed maximum volumetric or weighted amount of oxygen absorbed in a light-off catalyst presents a novel of unexpected result (See *In re Kuhle*, 526 F.2d 553, 188 USPQ 7 (CCPA 1975)).

Re claims 6-7, the apparatus of Murachi et al. discloses the invention as cited above, however, fails to disclose that an amount of oxygen absorbed on the three-way catalyst of the exhaust gas purifying means is not greater than about 150 cc per one-liter volume of the catalyst when measured by an oxygen pulse method and that an oxygen component stored in the three-

way catalyst of the exhaust gas purifying means is not greater than about 25 gr per one-liter volume of the catalyst.

One having ordinary skill in the art of exhaust emission control would have recognized that the specification of the maximum volumetric or weighted amount of oxygen absorbed in the exhaust gas purifying means would be a function of many variables such as the size of the exhaust gas purifying means, engine size, engine operating conditions (load, speed, etc), air and fuel properties, capacity and size of a main catalyst, etc. Moreover, there is nothing in the record which establishes that the claimed maximum volumetric or weighted amount of oxygen absorbed in the exhaust gas purifying means presents a novel of unexpected result (See *In re Kuhle*, 526 F.2d 553, 188 USPQ 7 (CCPA 1975)).

6. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of Hepburn'788 as applied to claim 23 above, and further in view of Hepburn (U.S. Patent 5,743,084) (Hepburn'084).

The apparatus of Murachi et al. further comprises control means for recovering the NO_x catalyst by reducing the oxygen concentration in the exhaust gas such that the CO that has passed through the light-off catalyst is introduced to the NO_x catalyst when a NO_x conversion efficiency of the NO_x catalyst is decreased and maintaining the reduced oxygen concentration until absorbed NO_x in the NO_x catalyst is released.

Murachi et al., however, fail to disclose that the control means further calculates the NO_x conversion efficiency after the recovery, and regenerating the NO_x catalyst to release SO_x only when the NO_x conversion efficiency, calculated after the recovery, is less than a threshold value.

As illustrated in Figure 1 and 7, Hepburn'084 teaches a method to remove SO_x from a NO_x trap (32), in which a lean time (T1) between two adjacent rich spikes is reduced when a NO_x storage or conversion efficiency is lower than a threshold value (step 112 with YES answer and step 114). A SO_x purge is performed only after a NO_x purge is performed and when the lean time is less than a predetermined value (step 90 with NO answer and step 120). It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the method taught by Hepburn'084 in the apparatus of Murachi et al., since the use thereof would have maintained high NO_x purification efficiency by timely purging SO_x trapped in the NO_x purifying catalyst.

Prior Art

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure and consists of four patents: Itou et al. (U.S. Patent 6,233,923), Kubo et al. (U.S. Patent 6,263,666), Takahashi et al. (U.S. Patent 6,341,487), and Surnilla et al. (U.S. Patent 6,418,711) further disclose a state of the art.

Communication

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Tu Nguyen whose telephone number is (571) 272-4862.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Thomas E. Denion, can be reached on (571) 272-4859. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Tu M. Nguyen

TMN

March 5, 2005

Tu M. Nguyen
Primary Examiner
Art Unit 3748